

WHAT IS CLAIMED IS:

1. A membrane process for the production of a
desired very high purity permeate gas product from a
feed gas mixture containing less than 40 vol% of the
desired permeate gas, which process comprises providing
in a primary stage the process feed gas mixture to a
primary membrane separator unit comprising a membrane
having a relatively high intrinsic permeability, to
provide an intermediate permeate gas and a retentate
gas, and providing the intermediate permeate gas in a
secondary stage to a secondary membrane separator unit
comprising a membrane having a relatively high
selectivity, to produce therefrom a very high purity
permeate gas product.

2. A membrane process as in claim 1, wherein the
primary membrane separator unit comprises a membrane
with an intrinsic permeability of more than 250
Barrer/cm $\times 10^4$.

3. A membrane process as in claim 1, wherein the
secondary membrane separator unit comprises a membrane
with an intrinsic permeability of 250 Barrer/cm $\times 10^4$ or
less.

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4. A membrane process as in claim 1, wherein the primary membrane separator unit comprises a membrane with an intrinsic permeability of more than 250 Barrer/cm $\times 10^4$ and a secondary membrane separator unit comprises a membrane with an intrinsic permeability of less than 250 Barrer/cm $\times 10^4$.

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5. A membrane process as in claim 1 wherein the intermediate permeate gas comprises from 40 vol% to 80 vol% of the gas to be provided as the very high purity permeate gas product.

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6. A membrane process as in claim 1 which further comprises using the products of fossil fuel combustion as the process feed gas mixture.

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7. A membrane process as in claim 1 which further comprises using the products of hydrocarbon combustion in air as the process feed gas mixture.

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8. A membrane process as in claim 1 which further comprises using the products of fossil fuel combustion in a lime kiln as the process feed gas mixture.

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9. A membrane process as in claim 1, which further comprises using a process gas stream containing 25 vol% or less of carbon dioxide as the process feed gas mixture.

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10. A membrane process as in claim 1, which further comprises using a process gas stream containing 11.7 vol% or less of carbon dioxide as the process feed gas mixture.

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11. A membrane process as in claim 1 which further comprises the recovery of carbon dioxide as a final permeate gas product at a purity of more than 96.0 vol%.

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12. An apparatus for the production by membrane passage of a very high purity permeate gas product, said apparatus comprising a means for providing a process feed gas mixture to a primary stage membrane separator unit, which unit comprises a membrane having a relatively high intrinsic permeability and a means for providing an intermediate permeate gas produced from said primary stage membrane separator unit to a secondary stage membrane separator unit, which unit comprises a membrane having a relatively low intrinsic permeability.

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